# Chapter 16
## Additional Aqueous Equilibria: Chemistry and the Ocean
Learning Objectives

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To satisfy the minimum requirements for this course, you should be able to:

1.  Explain the common-ion effect.

2.  Use a RICE table or the Henderson-Hasselbalch equation to calculate the pH of a solution in which the concentrations of acid and conjugate base are known, i.e. a buffer.

3.  Explain how a buffer works at the molecular level and be able to
    ● describe how to prepare a buffer of a given pH.
    ● define buffer capacity and explain its importance.
    ● calculate the change in pH of a simple buffer solution of known composition caused by adding a small amount of strong acid or strong base.

4.  Sketch the general shapes of acid-base titration curves and given a titration curve, identify the titration as a:
    ● titration of a strong acid with a strong base (or vice-versa).
    ● titration of a weak acid with a strong base.
    ● titration of a weak base with a strong acid.

5.  Inspect a titration curve and:
    ● identify the dominant species present at various points in a titration.
    ● identify the equivalence point and calculate the volume of titrant required to reach the equivalence point.
    ● identify the buffer region for the titration of a weak acid with a strong base or the titration of a weak base with a strong acid.

6.  Calculate the pH at the beginning, equivalence point and the half-equivalence point of a titration curve.

7.  Define the solubility-product constant ($K_{sp}$ found in Table A5.4, Appendix 5, pp. APP-28) for a salt and
    ● write the $K_{sp}$ expression for a given reaction or the balanced chemical equation for a given $K_{sp}$.
    ● calculate $K_{sp}$ from solubility data and solubility from the value of $K_{sp}$.
    ● describe and calculate the effect of an added common ion on the solubility of a slightly soluble salt.
    ● describe the qualitative effect of a change in pH on the solubility of salts.
    ● calculate the reaction quotient, $Q$, determine whether precipitation will occur.

8.  NavApp:  Boiler Water
    ● apply the concepts and equations of buffers to COPHOS
    ● recognize that the $K_{sp}$ values are very small for substances that make up boiler scale and sludge